STATEMENT BY:

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BEFORE THE UNITED STATES SENATE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
SUBCOMMITTEE ON FISHERIES, WILDLIFE, AND WATER

REGARDING:

DRAFT BIOLOGICAL OPINIONS ISSUED BY NATIONAL MARINE FISHERIES SERVICE AND U. S. FISH AND WILDLIFE SERVICE

ON

OPERATION OF FEDERAL COLUMBIA RIVER POWER SYSTEM

AND FEDERAL CAUCUS BASINWIDE SALMON RECOVERY STRATEGY

Boise City Council Chambers
150 North Capitol Boulevard
Boise, Idaho

November 20, 2000

Mr. Chairman, my name is Karl Dreher. I serve the State of Idaho as the Director of the Idaho Department of Water Resources, a position that I have held since 1995.

I appreciate your invitation to testify at this hearing and would like to share with you some of my concerns with the Draft Biological Opinion on Operation of the Federal Columbia River Power System ("Draft BiOp") released by the National Marine Fisheries Service ("NMFS") on July 27, 2000. My comments focus on two aspects of the Draft Biological Opinion: (1) the inadequacy of the science relied on by NMFS in continuing to call for flow augmentation in the mainstem of the Snake River; and (2) the flawed analysis conducted by NMFS in assessing the effects of the Bureau of Reclamation projects in the Upper Snake River Basin.

1. <u>Inadequacy of Science Used to Justify Flow Augmentation in the Mainstem Snake River</u>

Figure 1 shows the historical record of average daily flows in the Snake River near the site of Lower Granite Dam, since records have been kept, during the spring time period (April 10 through June 20) for which NMFS has established a target flow objective for the Snake River at Lower Granite Dam to aid outmigrating spring/summer chinook salmon. Similarly, Figure 2 shows the historical record of average daily flows in the Snake River during the summer time period (June 21 through August 31) during which NMFS has established a target flow objective in the Snake River to aid outmigrating fall chinook salmon.

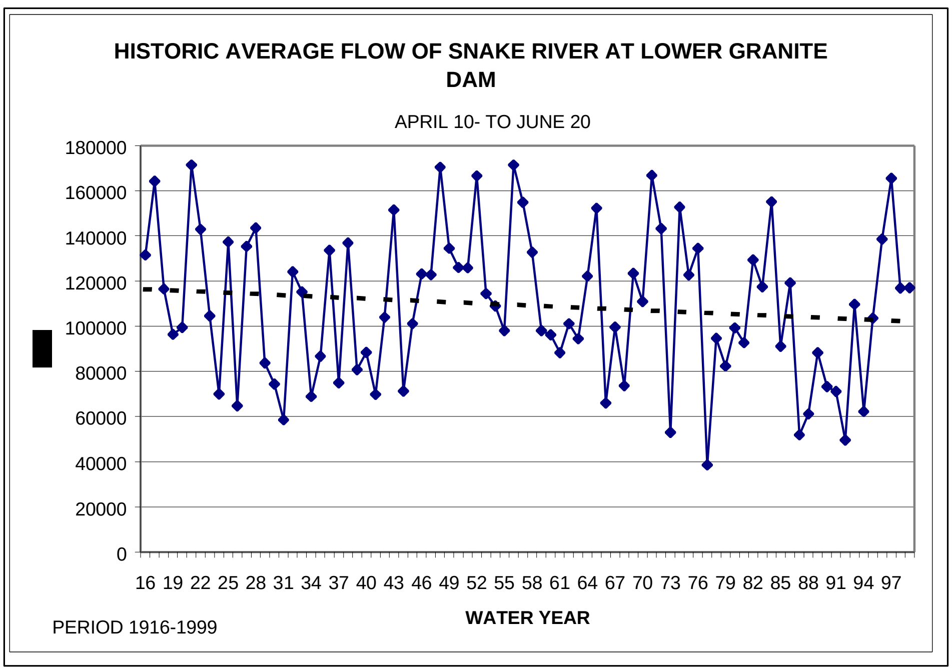


Figure 1. Average Daily Flows in the Snake River Near Lower Granite Dam
During Spring Target Flow Period

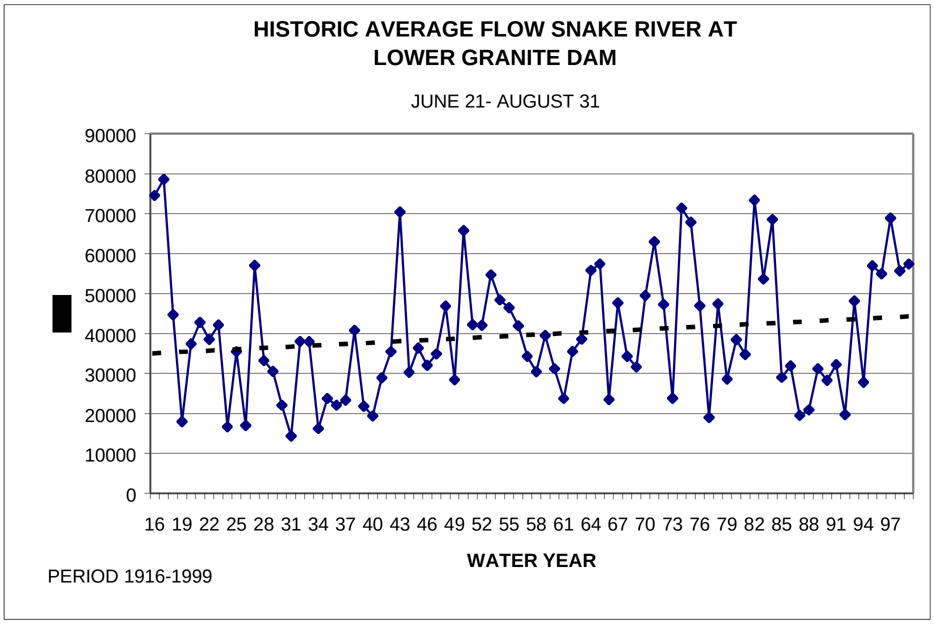


Figure 2. Average Daily Flows in the Snake River Near Lower Granite Dam
During Summer Target Flow Period

To assist in evaluating these historical flows, a linear trend line was calculated during each of the spring and summer target flow periods. The striking conclusion that can clearly be drawn from these data is that despite the increasing development of irrigated agriculture in the Snake River Basin, despite the development of municipal and industrial water supplies, despite the upstream development of hydroelectric power plants, despite the construction of Dworshak Reservoir for flood control, and despite the construction of Bureau of Reclamation storage reservoirs in the Upper Snake River Basin, flows have not changed significantly. During the spring target flow period, average daily flows range from about 50,000 cfs to about 170,000 cfs; from prior to 1920 to the current time. During the summer target flow period, average daily flows range from about 20,000 cfs to about 70,000 cfs; again from prior to 1920 to the current time.

The lack of dramatic change in flows is significant because analyses conducted by the Process for Analyzing and Testing Hypotheses ("PATH") concluded that the productivity of Snake River spring/summer chinook populations remained healthy through the 1950s and into the 1960s. Consequently, changes in Snake River flows can't have contributed to the loss of salmon productivity (because the flows haven't changed), and it should not be expected that increasing flows will significantly improve salmon productivity because there have been no significant flow depletions to contribute to the loss of productivity.

If flows have not changed during the time period when salmon productivity declined to the point that Snake River salmon and steelhead stocks were listed under the Endangered Species Act, what has changed? Figures 3 and 4 show the historic record of average daily flows during the spring and summer target flow time periods together with a parameter termed “water particle travel time”[1], which is a surogate parameter for average velocity.

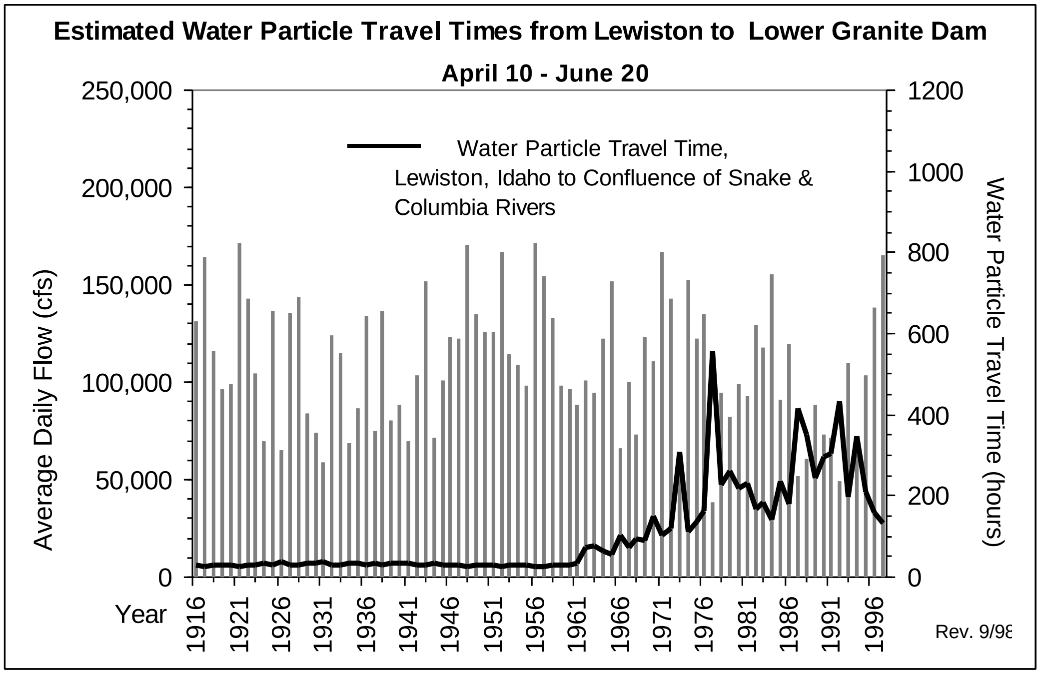


Figure 3. Average Daily Flows in the Snake River Near Lower Granite Dam and Water Particle Travel Time During Spring Target Flow Period

These figures show that prior to the construction of the four Federal Columbia River Power System (“FCRPS”) dams on the Snake River above its confluence with the Columbia River, water particle travel time, and hence the average velocity of river flow, were largely independent of flow. Since the construction of the four FCRPS dams, which have transformed a formerly free-flowing river into a series of reservoirs, thereby increasing the cross-section of the river, the average velocity of river flow has been slowed by an order of magnitude and is now significantly dependent on flow.

[1] Water particle travel time is the theoretical length of time that it would take a particle, suspended in a volume of water flowing at a given rate, to travel some specified distance. An average velocity can be calculated by dividing the specified distance by the water particle travel time. The specified distance in this instance is the length of the river segment from between the confluence of the Clearwater and Snake Rivers to the confluence of the Snake and Columbia Rivers, about 140 miles.

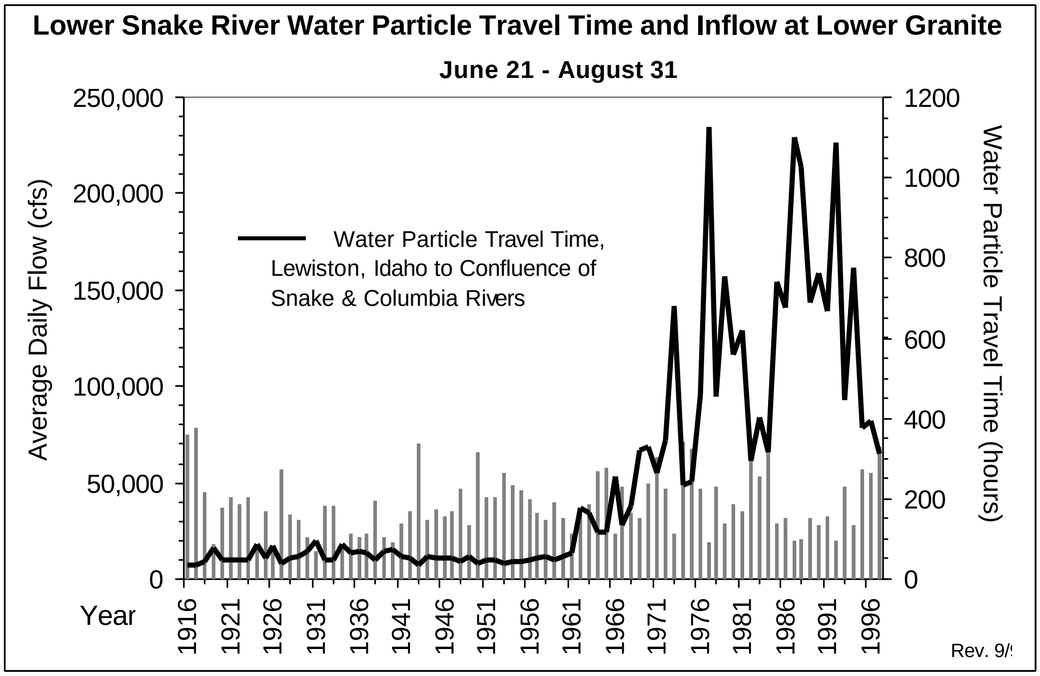
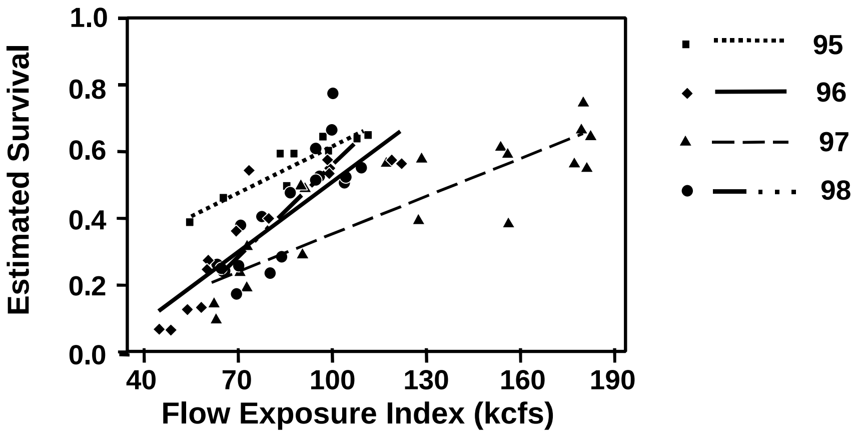


Figure 4. Average Daily Flows in the Snake River Near Lower Granite Dam and Water Particle Travel Time During Summer Target Flow Period

This slowing of river flows following construction of the four FCPRS dams, coupled with observations that improved adult returns are generally associated with good water years (i.e., high natural flow and spill) during juvenile outmigration, have led to the hypothesis that augmenting flows in the mainstem Snake River will increase flow velocities, decrease the travel time of outmigrating smolts by pushing them downstream, and thus improve their survival. However, there has been little recognition by NMFS in the Draft BiOp and supporting documents that flow augmentation can only provide small and probably insignificant increases in flow velocities.

In part to test the hypothesis that flow augmentation improves survival of outmigrating juvenile salmon by speeding downstream migration, NMFS, the U.S. Fish and Wildlife Service, and the Nez Perce Tribe investigated migration characteristics of hatchery-raised, spring/summer and fall chinook salmon in the Snake River using hatchery-raised juveniles as surrogates for wild juveniles. The studies were conducted during the period from 1995 through 1998 and showed that estimated survival from points of release to the tailrace of Lower Granite Dam could be correlated with all three environmental variables examined (flow rate, water temperature, and turbidity), at least for fall subyearlings, as shown in Figure 5. Estimated fall subyearling survival decreased throughout the season, as flow volume and turbidity decreased and water temperature increased. These correlations have been used by NMFS as the primary basis in the Draft BiOp for the continuation of flow augmentation from reservoirs in the Snake River and Clearwater River Basins to aid outmigrating juvenile subyearling fall chinook salmon.



Adapted from NMFS White Paper on Salmonid Travel Time and Survival
Related to Flow in the Columbia River Basin, March, 2000

Figure 5. Estimated Survival Versus Flow for Outmigrating Fall Chinook

However, an elementary principal of statistics is that correlation between variables does not equate to cause and effect. Based on an analysis of the 1995-1998 data relied on by NMFS, these data do not support a conclusion that higher flows achieved by use of flow augmentation cause an increase in survival. Attached to this written statement is a copy of the executive summary from a recent collaborative study completed by the Idaho Department of Water Resources, the Idaho Water Resources Research Institute (University of Idaho), and the Idaho Department of Fish and Game. Using the 1995-1998 data relied on by NMFS, it was found that most of the hatchery-raised fall chinook surviving to Lower Granite Dam traveled faster, not slower, during lower flows. This is shown in Figure 6 below and is completely opposite of what would be expected if incrementally higher flow velocities caused increased survival.

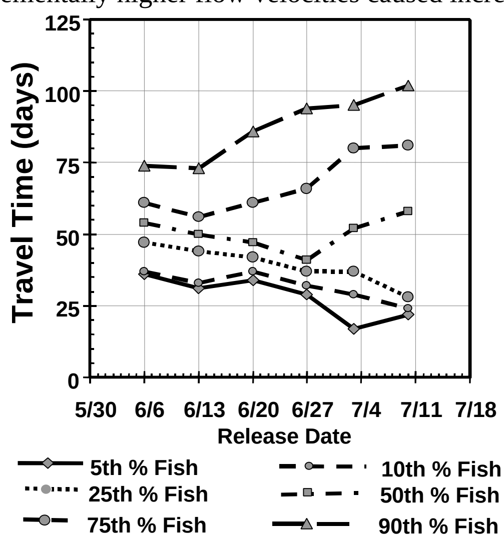


Figure 6. Subyearling Fall Chinook Travel Time for 1996 Clearwater Releases

Current data do not provide a sufficient basis for concluding that the relatively high mortality occurring after the release of hatchery-raised fish, especially from later releases, is related to flow rate. An inability to transition from a cultured environment to a natural environment may result in high mortality shortly after release. This post-release mortality is incorporated into survival estimates. If it is relatively high, this initial mortality could strongly influence observed survival patterns, even when the cause of mortality can not be shown to be related to flow conditions. For example, water temperature differentials between the hatchery and the river release sites were not constant among release groups. The temperature differential was relatively minor for early releases, but more dramatic for later release groups. Although fish were acclimated prior to release, and acute mortality monitored in net pens, the additional thermal stress on later release groups may have contributed to lower observed survival at Lower Granite Dam than for earlier release groups. Another variable – that is termed herein as "readiness to migrate" – may also have influenced hatchery-raised, fall chinook migration rates and survival. Fish from the early release groups may have been released prior to the time of optimal physiological conditions for migration and, therefore, migrations were delayed. Evidence for this possibility is the delay between dates of release and dates of detections at Lower Granite Dam for early releases as compared to later releases. Subyearlings from the later release groups may have been released at the end of, or after, their optimal physiological time for migration, although a few of the fish from late releases appeared to "catch up," as shown by faster travel times, despite lower flow conditions, as compared with earlier releases.

The inadequacy of the studies used by NMFS to investigate survival under varying flow conditions does not suggest that flow, specifically the attributes of flow (water velocity, temperature, and turbidity), are unimportant to migration and survival of juvenile salmon. However, flow rates, velocity, temperature, and turbidity are closely correlated with one another within the 1995-1998 data set used by NMFS to justify continued flow augmentation in the Draft BiOp, and the current data are insufficient to allow delineation of the effects of individual attributes of flow. Understanding the effects of individual attributes of flow, particularly the usefulness of flow augmentation to compensate for the effects of reservoir impoundment on these attributes, is fundamental to determining the effectiveness of flow augmentation efforts for increasing survival of juvenile salmon. For example, if cooler water temperatures are important to improving the survival of juvenile subyearling fall chinook salmon, using relatively warm water from the Upper Snake River to augment flows may be counterproductive and may harm subyearling fall chinook if river flows augmented with water from the Upper Snake River Basin are warmer than what would have occurred without flow augmentation from the Upper Snake.

2. Flawed Analysis Assessing Effects of Bureau of Reclamation Projects

The Draft BiOp discusses the flow depletion effects of irrigation stemming from Bureau of Reclamation ("BOR") projects in the Upper Snake River Basin and concludes that: "Flow depletions caused by BOR-based irrigation are a major impediment to meeting NMFS's flow objectives." BiOp at 6-28. This assertion is based on two analyses: (1) the estimated monthly average water consumption of crops at BOR irrigation projects upstream of McNary Dam; and (2) the percentage of years that simulated mean monthly flows at certain other dams are not met as a result of BOR-based irrigation. These analyses contain factual errors, apply fundamentally flawed logic in defining the effects of the action, and present a grossly misleading picture of the flow impacts of Bureau operations.

The conceptual flaw in the approach used by NMFS to assess BOR impacts is that the approach focuses on the time that reservoir storage is released during the irrigation season and the consumptive use by the crops irrigated by this water. Because irrigation occurs primarily during the salmon migration season, NMFS assumes that BOR projects have a substantial effect on flows during the migration season. This approach overlooks a simple but absolutely crucial fact: most of the water released from BOR reservoir storage space for irrigation purposes was stored after the irrigation season during the winter and high run-off periods in the spring. Without storage in a BOR reservoir, the water would have flowed downstream and would not have been in the river at the time that it is delivered for irrigation. Thus, water stored during the winter and spring that is released for irrigation in the summer does not reduce natural flows during salmon migration periods, but may actually increase flows during salmon migration since a substantial portion – roughly half – of the stored water that is released for irrigation finds its way back to the river as return flow. To correctly determine the effect of BOR reservoirs, NMFS must look to the volume and timing of both reservoir storage and return flows during the salmon migration periods.

In wrongly determining the percentage of years that operation of the BOR projects would cause a failure to meet flow objectives at Lower Granite and other dams based on a fifty-year period of record (1929-1978), the Draft BiOp uses a comparison of flows under current BOR operations with flows under a simulated "without BOR depletion" scenario. BiOp at 6-31. Two flaws in the NMFS analysis are readily apparent. First, the amount of depletion caused by BOR-based irrigation is overstated by approximately 50 percent. NMFS failed to distinguish between full service lands, which use Bureau storage as a primary water supply, and supplemental lands, which rely on Bureau storage as a secondary source. The difference in water use patterns between the two types of lands can be substantial. For instance, full service lands in the Boise River Basin used 2.18 acre-feet of storage per acre, while supplemental lands used 0.66 acre-feet of storage water per acre. NMFS simply assumed that all lands used Bureau storage as their sole source of water. Secondly, the analysis of the percentage of years that operation of the BOR projects would prevent meeting flow targets continues the error of basing the analysis on agricultural depletions rather than actual reservoir storage and return flows. The analysis calculates the total depletion due to all agriculture, assigns a fraction of that total depletion to BOR-based irrigation, and assumes that the BOR-based depletion occurs primarily during the salmon migration season. As explained previously, this overlooks the distinction between the timing of diversions to reservoir storage, which deplete flows at the time storage occurs, and diversions pursuant to natural flow water rights, which deplete flows at the time the diversion occurs.

This Draft Bi-Op analysis also reveals another basic misconception in the NMFS analysis of BOR impacts. In developing the "without BOR depletions" scenario, NMFS eliminated all irrigation storage, diversions, and return flows. This "pre-development" scenario stretches the available data and analytical tools well beyond their reliable use, and placess the entire analysis well into the realm of speculation. Unfortunately, NMFS then took the analysis one stunning step further; it assumed that the BOR reservoirs would remain in place and would be actively employed soley to augment flows for salmon. In other words, NMFS calculated the effects of operating the BOR projects on streamflow as the sum of: (1) the depletions that NMFS attributed to BOR-based irrigation; and (2) the volume of water that would have been available if the BOR reservoirs were actively operated solely to augment flows. Thus, NMFS treated the failure to dedicate Bureau reservoirs to flow augmentation as an "effect of the action" for the operation of Bureau projects. The Endangered Species Act does not allow NMFS to measure the effects of the operations at BOR projects against some artificial scenario that sweeps agriculture from the landscape of southern Idaho and then assumes that Congress would have authorized and funded major water projects for fish flow augmentation purposes.

3. Insufficient Collaboration with Regional and Local Interests

Mr. Chairman, I recognize the breadth of disagreements on these issues and others among scientists employed by federal, state, and local governmental entities, as well as scientists associated with other interest groups. However, given the significance of salmon recovery to the Pacific-Northwest and the nation, coupled with the inevitable costs of recovery actions, the limited collaboration that has occurred with regional and local interests has been wholly inadequate. Had adequate collaboration occurred, the insufficiencies in the science I have described could have been addressed before the Draft Bi-Op was finalized. While NMFS may address these flaws to some extent in the ensuing final Biologic Opinion, the lack of adequate collaboration has undoubtedly increased the likelihood and scope of subsequent litigation – litigation which will only serve to slow implementation and diminish the effectiveness of meaningful and feasible recovery actions.

Thank you for inviting me to testify today. I would be pleased to answer your questions or provide any supplemental information your Subcommittee may find useful.

REVIEW OF SURVIVAL, FLOW, TEMPERATURE, AND MIGRATION DATA FOR HATCHERY-RAISED, SUBYEARLING FALL CHINOOK SALMON ABOVE LOWER GRANITE DAM, 1995-1998

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Entire report is available from:

http://www.idwr.state.id.us (see listing on home page), or

http://www.idwr.state.id.us/info/pio/issues/IDWR-IDFG%20Flow%20&%20Survival%20Review.pdf

Executive Summary

The National Marine Fisheries Service (NMFS), the U. S. Fish and Wildlife Service, and the Nez Perce Tribe have investigated migration characteristics of hatchery-raised, subyearling fall chinook salmon (*Oncorhynchus tshawytscha*) in the Snake River Basin from data collected from 1995 through 1998 (Muir et al., 1999). The studies showed that estimated survival from points of release to Lower Granite Dam could be correlated with three environmental variables: flow, water temperature, and turbidity. These correlations are being used in support of flow augmentation in the lower Snake River.

This report provides a review of the data used for comparing subyearling survival to flow rates, water temperature, time of release, and travel time. The principal conclusion of the review is that survival data and flow rates used by Muir et al. (1999), despite showing an apparent correlation between flow rates and survival, do not imply a cause and effect relationship between flow and survival of subyearlings and should not be used as a basis to justify flow augmentation. This is primarily because the experimental design did not address other factors that appear to have strongly influenced migration characteristics and survival.

There is a fourfold basis for this conclusion. First, although flow can be correlated with survival, there is a stronger correlation between estimated survival and release date. The NMFS experimental design assumed that sequential releases of hatchery-raised fall chinook would not influence survival independent of flow, temperature, and turbidity. The high correlation between time of release and survival makes this assumption questionable.

Second, travel times for hatchery-raised, subyearling fall chinook did not correspond with flow rates. For instance, travel times for the early percentile surviving fish (5th, 10th, and 25th percentiles) were **less** at lower flows than at higher flows for most releases. Median travel time for the 5th percentile surviving fish decreased from 33 days to 16 days between the 1st and 6th weekly releases, despite a decrease in the 5th percentile flow indices during the same time from 122 thousand cubic feet per second (kcfs) to 63 kcfs. These travel times and arrival patterns were contrary to what would be expected if the higher flows resulted in significant improvements in survival.

The fact that travel times are inconsistent with flow rates may result from (1) the migration rate being weakly dependent on flow in the flow ranges considered or (2) other important non-flow factors influencing migration rate. An example of a non-flow factor is “readiness to migrate.” The NMFS study used hatchery-raised, subyearling fall chinook as surrogates for wild fish. Implicit in the use of these hatchery-raised subyearlings in sequential weekly releases is that the fish are equally “ready to migrate” when released. Longer travel times for portions of early-released subyearlings, and faster travel times for portions of later-released subyearlings, despite substantially decreasing flows, suggests that the fish in the weekly sequential releases may not have been equally “ready to migrate.” Differences in states of “readiness to migrate” would confound the analysis of flow and survival relationships. Correlations of flow and temperature with travel time and survival are only meaningful if the groups of fish studied are actively migrating or relatively similar in their state of “readiness to migrate. ”

Third, flow rates, velocity, temperature, and turbidity are closely correlated with one another (NMFS, 2000). The current data are insufficient to allow delineation of the effects of individual attributes of flow. Understanding the effects of individual attributes of flow, particularly the usefulness of flow augmentation to compensate for the effects of reservoir impoundment on these attributes, is fundamental to determining the effectiveness of flow augmentation efforts for increasing survival of subyearling fall chinook salmon.

Fourth, additional problems with existing studies must be addressed prior to making conclusions about the efficacy of flow augmentation. These include use of flow and temperature indices that do not represent overall migration conditions; release timing of hatchery-raised fish that is not representative of natural migration; relatively high post-release mortality; and the inability of reach survival estimates to reflect the full spectrum of potential effects from altered water velocities, temperatures, and turbidity during migration (e.g., altered migration timing, bioenergetics, and transition into the estuary and ocean).

In summary, this review does not suggest that flow, or the attributes of flow (water velocity, temperature, and turbidity), are unimportant to migration and survival of subyearling fall chinook salmon. However, existing correlations between survival of hatchery-raised, subyearling fall chinook salmon with flow rates and water temperatures do not support the postulation that augmenting mainstem Snake River flows improves subyearling survival.